SOME EFFECTS OF EXCESS WATER IN THE SOIL UPON THE GROWTH AND DEVELOPMENT OF MAIZE

BY

WALTER LEE JOHNSON

B. S., Agricultural and Technical College of North Carolina, 1942
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SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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IN THE GRADUATE COLLEGE OF THE
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ACKNOWLEDGMENT

The author wishes to express his deep gratitude to Dr. George H. Dungan for his relentless efforts and helpful advice during the course of this research, and for his constructive criticism of the thesis. He is also very much indebted to Dr. O. H. Sears for his generous assistance with the greenhouse phase of this research and in the interpretation of the results. In addition he expresses his sincere appreciation to Dr. J. A. Jackobs for his invaluable guidance in connection with the statistical phase of this problem.

The writer wishes also to express his warm appreciation to his wife, Rita Doss Johnson, for her effective co-operation and inspiration, without which this effort would have been extremely difficult. He also wishes to express his thanks to his mother, Mrs. Euzzie Foreman Johnson, and to his mother and father-in-law, Mr. and Mrs. Elmer Doss, for their encouragement and moral support.

SOME EFFECTS OF EXCESS WATER IN THE SOIL UPON THE GROWTH AND DEVELOPMENT OF MAIZE

Abstract

Hundreds of acres of good crop land in the United States and other countries are flooded annually for different lengths of time after the crop has been planted. In this experiment information was sought on the effect of excess water at different times during the growing season on: (1) plant elongation; (2) root development; (3) date of tasseling and silking; (4) time of maturity as indicated by moisture content of the corn grain at harvest time; (5) mature plant height; and (6) the yield of corn grain.

Methods

Two field experiments were conducted, one during the summer of 1951 and one in 1952. During the summer of 1951 a 5x5 Latin square design was used. Plants were continuously flooded for a single six-day period at five different dates during the growth of the plants. Likewise, a Latin square design was used during the summer of 1952 with plants being flooded for a single ten-day period at 4 different dates during the growth of the plants. Size of plot was 4x4 hills rather than 5x5 as in 1951.

Three greenhouse experiments were conducted during 1951 and 1952. The first test was designed to show the harmfulness of flooding and the benefit of aeration. The treatments were as follows: Four pots of flooded soil were aerated; 4 pots were aerated but were not flooded; 4 pots were flooded but were not aerated; and 4 pots were not flooded and not aerated. The latter served as a check.

In the second greenhouse experiment, 24 two gallon pots were divided into 3 groups of 8 pots each. To the first group of eight pots 1½ grams of $Ca\ H_4(PO_4)_2$ plus 7 grams of sugar were added. Four of these were flooded continuously

and the other 4 pots were not flooded; to the second group of eight pots 1½ grams of Ca $H_4(PO_4)_2$, plus 1 gram of Ca $(NO)_3$ were added. Four of these pots were continuously flooded and 4 pots were not flooded; and to the third set of eight pots 1½ grams of Ca $H_4(PO_4)_2$ only were added to the soil with 4 pots being continuously flooded and 4 pots were not flooded.

The third experiment consisted of adding 1 gram of KCl to 4 two-gallon pots being continuously flooded and 2 pots serving as a check. To the second set of 4 pots 2 grams of KCl were added to the soil. Two pots were continuously flooded and 2 pots served as a check.

Summary of Results

The effect of excess water on corn plants has been studied in the field and in the greenhouse. The principal results obtained from these tests may be summarized as follows:

1. Plants flooded when they were young did not grow as tall as the plants which were flooded during their later stages of development.
2. Flooding corn plants for a period of 6 or 10 days in the early vegetative or vegetative stages of development was much more harmful to the growth and development of the plants than flooding in the early reproductive and pre-tassel stages of development.
3. Flooding plants during the 1951 field test did not delay silking and plant maturity to any observable extent, but in the 1952 test, which involved a flooding period of 10 days instead of 6, flooding was associated with a significant delay in silking and pollen shedding. This was particularly pronounced when the plants were young at the time they were flooded. This delay in silking carried over to the later growth stages and was manifest in high moisture at harvest time.
4. Plant tissue tests revealed that the blades of flooded plants contained very little, if any, nitrate nitrogen.
5. Grain yields were smallest when plants were flooded during their early stages of development.

6. Length of roots and height of plants were much greater when plants were grown in pots which were flooded and aerated than when plants were grown in pots which were flooded and not aerated.
7. Yields of tops and roots from plants grown in flooded and non-flooded pots followed the same general trend as the height of tops and length of roots.
8. Plants grown in soils which contained sugar were shorter in height and length of roots than those grown in soils not treated with sugar. Dry weights of roots from sugar treated pots were much smaller than those from plants grown in soils to which no sugar was added.
9. Plants grown in soils to which 2 grams of KCl were added were much taller and produced longer blades than those plants which grew in soils which contained only 1 gram of KCl per pot.

While excess water proved injurious in these tests natural flooding as observed on farmer's fields was more harmful to corn plants than the artificial flooding which was provided in these experiments.

VITA

Walter Lee Johnson was born in Greensboro, Guilford County, North Carolina, May 23, 1918. He attended grammar school in the Greensboro Public Schools and also the James B. Dudley High School, from which he was graduated in June, 1937.

He entered the Agricultural and Technical College of North Carolina at Greensboro in September, 1937, and received the degree of Bachelor of Science in 1942.

On October 26, 1942, the author entered the Army of the United States and served as an enlisted man. On January 28, 1943, he was promoted to the rank of Battalion Sergeant Major, which rank he held until his discharge in April, 1946. He served 21 months in the European theater of operations.

He entered the University of Illinois Graduate College in September, 1946, and received the degree of Master of Science in Agronomy in August, 1947.

After teaching for three years, September, 1947, to September, 1950, at Southern University, Baton Rouge, Louisiana, the author returned to the University of Illinois for further graduate study.

He is a member of Alpha Phi Alpha fraternity.